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WHO ARE THE NOISE TRADERS?

J. Christopher Hughen
Bowling Green State University

Cynthia G. McDonald
University of Missouri–Columbia

Abstract

Closed-end funds often trade at a discount to net asset value. Previous research suggests that the positive correlation in discounts is associated with investor sentiment that causes systematic mispricing by noise traders. We use a newly available sample of daily fund valuations to examine the relation between intraday trading activity and discount changes. Contrary to the assumption that retail investors are noise traders, we find no relation between discount changes and the order-flow imbalances of individual investors. Large daily discount changes are associated with institutional trading, and this may reflect the price inelasticity of closed-end fund shares.

JEL Classifications: G10, G12

I. Introduction

An essential issue in finance is the extent to which asset prices reflect fundamental values. Of particular interest is whether noise traders, who act on information that has no value, influence prices. Noise trading has a minimal effect on prices in an environment where rational arbitrageurs effectively reduce deviations from fundamental values. In other words, if individual investors make sentiment-motivated trades, arbitrageurs should step in to offset the effects of irrational actions by individual investors. Yet if significant arbitrage costs impede the trading activity of rational investors, asset prices can differ from fundamental values. The ability of arbitrageurs is limited if sentiment is cross-sectionally correlated and they face the risk of continued movements away from fundamental values. These conditions form the basis of the noise trader model, which shows that sentiment-motivated trading can cause prices to diverge substantially from fundamental value (De Long et al. 1990).

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Closed-end funds are particularly well suited for testing this model because funds regularly report net asset values (NAVs), thereby providing a unique opportunity to study the influence of noise traders on asset prices. Substantial differences between the prices of closed-end funds and the values of their underlying assets are consistent with the limited ability of arbitrageurs to eliminate mispricings (Pontiff 1996). Neal and Wheatley (1998) provide evidence consistent with systematic noise trader sentiment limiting arbitrage activity; they find that closed-end fund discounts reflect investor sentiment and predict returns. Although noise trader models do not specify which investors are the noise traders, circumstantial evidence suggests that individual investors are the noise traders, as individuals own most of the shares in these investment companies. Yet empirical studies fail to document a relation between discount fluctuations and transactions by a particular investor clientele.

This is the first study to relate daily discount fluctuations to trading by different clienteles. Previous research uses weekly NAVs and is therefore unable to analyze transaction characteristics on the day when changes in discounts occur. Indeed, we show that substantial discount changes occur on a daily basis. The absolute value of the daily discount change exceeds 1.82% in 1 of every 10 trading days in the sample. Contrary to the conjecture that individual investors are the noise traders in the noise trader models, we show that the order-flow imbalances of small investors are not associated with large changes in fund discounts. Instead, fluctuations in fund discounts are strongly correlated with trading activity of institutional investors, and this may be caused by price inelasticity.

We use two approaches to make inferences regarding the transactions associated with discount changes. First, we examine the trading activity on and around days with large changes in the fund discount. We provide evidence that the proportion of sell (buy) trades initiated by institutions increases on days when a discount widens (narrows), suggesting that institutional trading is associated with large discount fluctuations.[1] The average seller-initiated volume by individual investors falls on days when fund discounts exhibit large increases, and the average buyer-initiated volume by individual investors also falls when discounts have a large daily decrease.

Second, we use cross-sectional analysis to estimate the relations between a change in the discount and the order-flow imbalance of each investor type. We find a negative relation between discount change and order-flow imbalance of institutions, indicating that institutions are net sellers when the discount widens and net buyers when the discount narrows; we find no relation between change in the discount and trading activity of individual traders. Similarly, we find that a large change in the discount is most likely on a day with a large order-flow imbalance for institutional

[1] For expositional ease, we use the vernacular expression "discount widens" (narrows) when the fund price falls (increases) relative to its NAV. On average, funds sell at a discount to NAV.

traders. This may be a result of price pressure associated with the large trades of institutional investors.

II. Noise Traders and the Pricing of Closed-End Funds

The pricing of closed-end funds relative to NAV is one of the more puzzling anomalies in finance; closed-end funds persistently trade at a discount that fluctuates according to a mean-reverting pattern. Pontiff (1995) provides evidence that closed-end fund discounts predict returns, as portfolios of funds with the largest discounts experience higher returns than portfolios of funds with the smallest discounts. He shows that the superior performance of large discount funds is related to mean reversion in the discount.

Lee, Shleifer, and Thaler (1991) argue that if fluctuations in noise trader sentiment are correlated across noise traders, noise trader sentiment will affect many assets, and the risk fluctuations created cannot be diversified. Consistent with closed-end fund discounts reflecting investor sentiment, Lee, Shleifer, and Thaler show that discounts are correlated with the returns of small firm stocks. Neal and Wheatley (1998) find that fund discounts predict the returns of small firm stocks, held mostly by individuals, but do not predict returns of large firm stocks, held mostly by institutions. Similarly, Brown (1999) shows that volatility in closed-end funds is related to extreme levels of the American Association of Individual Investors' Sentiment Survey. The role of small investors in the pricing of closed-end funds is controversial, as other research rejects the implications of the noise trader model as applied to closed-end funds. Elton, Gruber, and Busse (1998) find little sensitivity of fund discounts to small stock returns or small investor sentiment. For a sample of 14 closed-end funds for which 12 weeks of intraday Trades, Orders, Reports, and Quotes (TORQ) data are available, Sias (1997) finds that individual and institutional investors are equally likely to cause discount fluctuations.

In addition to the sentiment of small investors, closed-end fund discounts may reflect rational expectations about the value of management control relative to distributions to other shareholders. In their cross-sectional analysis of closed-end fund discounts, Barclay, Holderness, and Pontiff (1993) find that the average discount on funds is larger for funds with blockholders (14%) than for those without blockholders (4%). The evidence is consistent with blockholders acquiring private benefits that are more valuable than the appreciation in share price that would likely result from an open ending.

Grullon and Wang (2001) argue that closed-end fund discounts reflect differences in the ability of institutional and retail investors to obtain and evaluate relevant information about the assets in which they invest. They show theoretically that discounts are affected by informational asymmetries and differences in the

institutional ownership in the funds and underlying assets. The empirical tests show that the discount increases with the quality of private information in the underlying assets. Within this scenario, discounts reflect the differential risk perceptions of institutional and individual investors.

Although various models predict that trades by a particular investor type are associated with changes in discounts, previous research fails to connect fluctuations in discounts with transactions of a particular investor clientele. Those findings could be a result of several methodological deficiencies. All research in this area examines discounts on a weekly basis. The frequency of these data is insufficient for analyzing the type of trading that occurs around large changes in discounts. By using newly available daily fund valuations and transactions-level data, we provide a unique analysis of the controversial role of trader clienteles in pricing closed-end funds.

III. Sample Selection and Description

The sample is from the 510 closed-end funds followed by CDA/Wiesenberger on January 15, 1999. We include closed-end funds with at least five months of daily NAVs. To minimize problems associated with nonsynchronous trading, we require each fund to have at least half of its portfolio invested in domestic stocks as of the last financial statement before January 15, 1999. Table 1 describes the 23 closed-end funds that satisfy these requirements. The average fund in the sample has almost 20 months of daily NAV data.

Intraday transactions are obtained from the New York Stock Exchange Trade and Quote (TAQ) database. We apply filters similar to those of Blume and Goldstein (1997) to eliminate possible errors from the TAQ database.[2] To reflect the differences in reporting times documented by Lee and Ready (1991), we adjust quote times by five seconds. From the day after each of the funds starts releasing daily NAVs until December 31, 1999, the TAQ database contains information on 1,313,355 bid-ask quotes and 544,507 trades for these securities.

Our examination of the composition of trading on days with large discount changes requires inferences regarding trade direction and trader type. Trade direction is determined using the Lee-Ready (1991) algorithm. We classify trades as buyer initiated (seller initiated) when the price is above (below) the prevailing

[2]Quotes that meet any of the following criteria are deleted from the analysis: the best bid price exceeds the best ask price by more than 50%, the best bid price differs from the previous best bid price by more than 50%, the spread of the best displayed quote exceeds 20% of the midpoint when the midpoint is at least $10, the spread of the best quote is above $2 when the midpoint is less than $10. Trades are ignored when the trade price differs from the prior trade price by more than 50% or the trade price is more than $5 away from the quote midpoint. In addition, transactions are removed from the sample when a quote is deleted and a new valid quote has not been made.

TABLE 1. Sample of Domestic Equity Closed-End Funds.

Fund Name	Ticker	Daily NAV	Investment Objective	% in Stocks	% in Prfrrds	% in Convert	% in Bonds	% in Cash	% in Other	Portfolio Turnover	Market Cap
Adams Express	ADX	08/18/97	Growth & income	94.3	0.0	0.5	0.0	5.2	0.0	19.2	1,324
Alliance All-Market Adv	AMO	10/13/97	Growth–domestic	73.3	0.0	0.0	0.0	1.3	25.4	96.0	115
Baker Fentress & Co	BKF	08/12/97	Growth & income	75.5	1.3	11.2	0.0	10.5	1.5	53.2	559
Blue Chip Value	BLU	09/05/97	Growth & income	99.5	0.0	0.0	0.0	0.5	0.0	22.4	149
C&S Total Rtrn Realty	RFI	03/09/98	Growth & income	97.2	0.0	0.0	0.0	2.8	0.0	35.0	97
Equus II	EQS	12/01/97	Growth–domestic	56.9	21.6	1.1	13.8	0.1	6.6	N/A	79
Gabelli Equity Trust	GAB	07/10/97	Growth–domestic	87.4	0.4	0.4	0.7	11.1	0.0	13.0	1,223
General American	GAM	10/04/96	Growth–domestic	67.7	0.0	0.9	0.0	31.4	0.0	13.7	742
H&Q Healthcare	HQH	06/14/96	Sector	72.4	0.0	15.5	0.0	12.1	0.0	17.2	144
H&Q Life Sciences	HQL	06/14/96	Sector	75.1	0.0	17.3	0.0	7.6	0.0	18.2	91
JH Bank & Thrift Oppty	BTO	08/24/94	Sector	93.8	0.0	0.9	0.0	0.0	5.4	6.0	878
Liberty All-Star Equity	USA	10/06/97	Growth & income	97.9	0.3	0.0	0.0	1.8	0.0	39.0	1,163
Liberty All-Star Growth	ASG	10/06/97	Growth–domestic	97.8	0.0	0.0	0.0	2.2	0.0	16.0	153
MFS Special Value Trust	MFV	08/09/96	Growth & income	91.0	0.0	0.8	2.4	5.8	0.0	41.0	100
Morgan Grenfell SmCap	MGC	06/16/98	Growth–domestic	96.7	0.0	0.0	0.0	0.0	3.3	N/A	97
Petroleum & Resources	PEO	08/18/97	Sector	86.6	0.0	5.3	0.0	8.1	0.0	11.6	414
Royce Micro-Cap Trust	OTCM	10/11/96	Growth–domestic	83.0	0.0	0.0	5.2	0.0	11.8	17.0	113
Royce Value Trust	RVT	10/11/96	Growth–domestic	84.3	0.0	0.5	3.0	0.0	12.2	17.0	440
Salomon Brothers Fund	SBF	06/11/98	Growth–domestic	81.6	0.0	1.9	1.0	2.1	13.4	34.0	1,543
Source Capital	SOR	12/15/97	Growth & income	79.7	0.5	8.7	7.0	4.1	0.0	22.2	371
SE Thrift and Bank Fund	STBF	04/12/96	Sector	91.4	0.0	0.0	0.0	8.6	0.0	5.0	86
Tri-Continental Corp	TY	08/09/96	Growth & income	91.1	0.0	0.0	6.3	2.2	0.4	30.8	3,172
Zweig Fund	ZF	08/18/97	Growth–domestic	69.8	0.0	0.0	7.6	22.6	0.0	36.9	642

Note: This study provides an analysis of the following sample of domestic equity closed-end funds. Daily NAV refers to the date when the fund started releasing daily net asset values. The investment objective is a classification of funds defined by CDA/Wiesenberger. Columns 5 through 12 describe the fund's portfolio using information taken from the most recent financial statement as of January 15, 1999. Columns 5 through 10 present the portion of the fund's portfolio invested in common stocks, preferred stocks, convertible securities, bonds, cash, and other securities. The portfolio turnover is expressed in percentages, and the market capitalization is provided in millions of dollars as of January 15, 1999.

quote midpoint. Transactions at the bid-ask midpoint are classified using the tick test. Odders-White (2000) finds that this classification system correctly identifies the trade direction for 85% of the transactions in her sample.

Inferences on trader type are based on the algorithm provided by Lee and Radhakrishna (2000) in their examination of whether trade size can be used to differentiate between transactions of individuals and institutions. We classify all trades with a value less than or equal to $5,000 as trades initiated by individual investors, and transactions involving at least $10,000 as institutional trades. When a round lot of a fund cannot be purchased for $5,000, round lot trades are classified as initiated by individual investors and trades involving more shares are classified as institutional trades. A buffer zone of medium trades ($5,000 < trade value < $10,000) is used to minimize misclassifications. The closed-end funds in our sample have similar market values to the small firms in the Lee and Radhakrishna sample. Lee and Radhakrishna find that 81% of all trades initiated by individual investors have a value below $5,000. Using a $5,000 to $10,000 buffer zone reduces to 5% the probability that an individual trade is erroneously classified as institutional.[3]

We calculate the premium as the natural logarithm of the bid-ask midpoint divided by NAV; using quote midpoints minimizes the effects of bid-ask bounce. The discount is the negative of the premium. A change in the discount or premium represents the difference in the returns of the fund's share price and NAV. Figure I shows the average weekly premiums for all 23 funds from 1995 to 1998. The plot illustrates the substantial fluctuations in relative prices and NAVs, as average weekly premiums vary between –3.1% and –13.6%. Consistent with previous studies, fund prices are generally lower than NAVs.

Table 2 provides descriptive statistics on the trading of the 23 closed-end funds in the sample. The first three rows describe the magnitudes and fluctuations of the discounts. The share price ranges between a 34.57% discount and a 42.09% premium on NAV. The median discount is 10.66%. Although the median daily change in the discounts is zero, the minimum and maximum are large: –11.91% and 11.48%, respectively. For 10% of the trading days in the sample period, the absolute value of the daily discount change exceeds 1.82%. These statistics indicate that the ratios of price to fundamental value makes sharp changes over short periods.

Table 2 also describes the trading activity in the 23 funds. The median daily dollar volume in these funds is $537,144, but as shown by the maximum ($23,170,900) and minimum ($3,800), there is considerable variation in the amount of trading in these funds. Consistent with this observation, the median share

[3] Lee and Radhakrishna (2000) find that a dollar-based proxy produces fewer erroneous classifications than does an approach using cutoffs based on share size They also investigate the accuracy of assuming institutional (individual) investors initiate all trades above (below) a certain percentile of size. For example, a researcher might assume that institutional investors initiate the largest 20% of the trades in a stock. This method performed worse than an approach using either a dollar-based cutoff or a share-based cutoff.

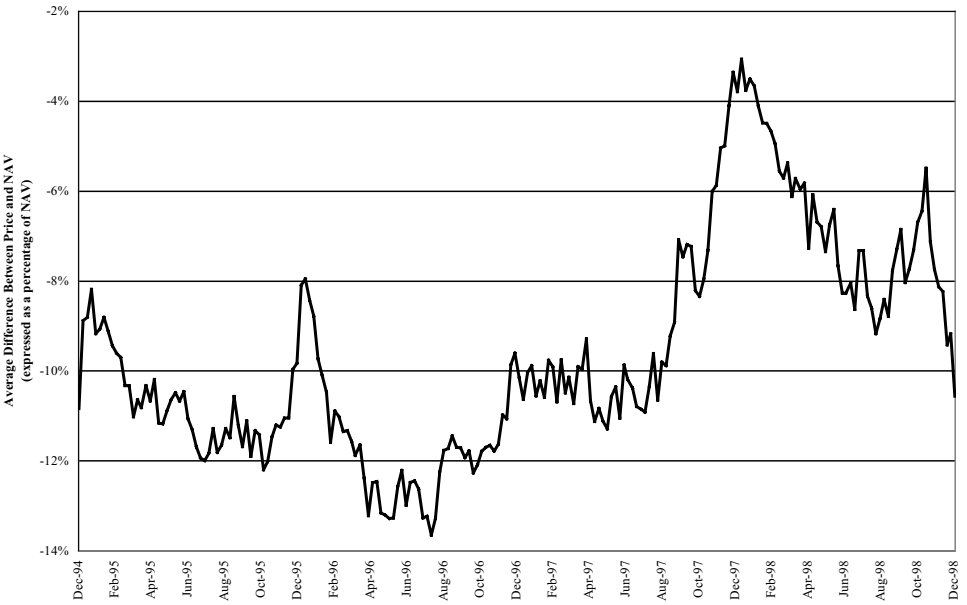

Figure I. Average Closed-End Fund Discount. Using weekly data from January 6, 1995, to December 31, 1998, this figure shows the average percentage difference between fund price and net asset value (NAV) for the sample of 23 domestic equity closed-end funds described in Table 1.

volume is 30,700 and ranges from 200 to 1,618,000. The median number of trades executed in one fund day is 39. A summary of the trading attributed to individual and institutional investors is provided. The median share volume (median trades) initiated by individuals is 2,000 (13), the median share volume (median trades) of medium trades is 4,700 (9), and the share volume (median trades) for institutional investors is 22,900 (16). Trades with values of at least $10,000 account for 42% of the median number of daily trades and 77% of the median volume.

IV. Changes in Closed-End Fund Discounts

Univariate Analysis

We first examine the relation between discount change and the order-flow imbalance associated with individual and institutional investors. Order-flow imbalance is defined as buyer-initiated volume minus seller-initiated volume. The relative order-flow imbalance is order-flow imbalance divided by total trading volume. Correlation coefficients are estimated separately for each fund, and the average coefficient is presented in Table 3. The percentages of the 23 coefficients that are the same sign and significant at the 10% level are shown in parentheses.

TABLE 2. Discounts and Trading Activity for Closed-End Funds.

	Maximum	90th Percentile	Median	10th Percentile	Minimum
Discount	42.09%	19.96%	10.66%	−6.22%	−34.57%
Change in discount	11.48%	1.31%	0.00%	−1.29%	−11.91%
Absolute value of change	11.91%	1.82%	0.59%	0.11%	0.00%
Dollar volume	23,170,900	2,115,188	537,144	125,913	3,800
Share volume	1,618,100	120,200	30,700	6,200	200
Trade size ($)	170,420	22,578	13,267	7,793	1,800
Number of trades	957	125	39	13	1
Individual traders					
Share volume	78,200	7,500	2,000	400	0
Number	325	41	13	4	0
Medium-size traders					
Share volume	132,900	15,600	4,700	1,400	400
Number	262	30	9	3	1
Institutional traders					
Share volume	1,500,400	98,000	22,900	3,400	0
Number	500	57	16	3	0

Note: This table describes the discounts and trading activity for the 23 closed-end funds shown in Table 1 and reflects 9,318 fund trading days. The discount is calculated as the natural logarithm of net asset value (NAV) divided by the bid-ask midpoint. The Lee-Ready (1991) algorithm is employed to classify trades as initiated by a buyer or seller. The trader type is determined using guidelines developed by Lee and Radhakrishna (2000). This approach uses a buffer zone of medium-size trades, which are trades with values greater than $5,000 but less than $10,000. Individual investors are assumed to initiate trades with values below this buffer zone, and institutional investors are assumed to initiate trades that have values above the buffer zone. If the share price is greater than $50, trades of 100 shares are associated with individual investors.

As shown in Table 3, the correlation coefficient between the discount change and individual investor order flow (relative order flow) imbalance is –0.12 (–0.08). However, the strongest relation is between the discount change and the order-flow imbalance associated with large trades, with an average correlation coefficient of –0.23, and negative significant correlations for more than 95% of the funds. The large correlation between discount change and the order-flow imbalance of institutional investors suggests that larger trades have greater influence on fluctuations in the discount.

Large Changes in the Discount

We next examine the trading activity on and surrounding days when the discount makes a large change, where a large change in the discount is defined as greater than 3% in absolute value. Table 4 describes the trading activity on the 243 trading days with large changes in the discount. Average trading characteristics on days with large changes in the discount are compared with the weighted averages of trading activity for the full sample, where weights are based on the fund's percentage of large discount changes. The final column of Table 4 shows

TABLE 3. Correlation of Order-Flow Imbalance and Discount Changes.

	Correlation with Change in Discount
Order-flow imbalance	
Individual investors	−0.1248
	{69.57%}
Medium-size traders	−0.1643
	{69.57%}
Institutional investors	−0.2556
	{95.65%}
Relative order-flow imbalance	
Individual investors	−0.0812
	{47.83%}
Medium-size traders	−0.1170
	{60.87%}
Institutional investors	−0.2382
	{95.65%}

Note: This table provides an analysis of the 23 closed-end funds described in Table 1. The sample consists of 9,318 daily observations. Correlation coefficients are estimated separately for each fund, and the average coefficient is presented. The percentages of the 23 coefficients that are the same sign and significant at the 10% level are shown in parentheses. The Lee-Ready (1991) algorithm is employed to classify trades as initiated by the buyer or seller. The trader type is determined using guidelines developed by Lee and Radhakrishna (2000). This approach uses a buffer zone of medium-size trades, which are trades with values greater than $5,000 but less than $10,000. Individual investors are assumed to initiate trades with values below this buffer zone, and institutional investors are assumed to initiate trades that have values above the buffer zone. If the share price is greater than $50, trades of 100 shares are associated with individual investors.

TABLE 4. Trading Activity on Days with Large Discount Changes.

	Large Discount Changes	Full Sample	Percentage Difference
Discount	5.42%	6.48%	
Absolute value of change	4.30%	0.97%	
Dollar volume	1,443,745	727,445	98.5%
Share volume	103,594	43,848	136.3%
Trade size ($)	13,822	12,996	6.4%
Number of trades	94	51	85.4%
Trading activity by size			
Share volume initiated by individuals	6,619	3,160	109.4%
Trades initiated by individuals	32	17	81.9%
Share volume of medium-size trades	12,501	5,705	119.1%
Trades of medium size	23	12	84.8%
Share volume initiated by institutions	82,353	33,800	143.6%
Trades initiated by institutions	40	21	92.7%

Note: This table compares the average trading activity on days with large discount changes to a weighted average for the full sample. The statistics in the second column are computed using the transaction data for the 243 days when the absolute discount change exceeded 3%. The averages in the third column are calculated by weighting each fund's full data by the fund's percentage of large discount changes.

the percentage difference between days with large discount changes and the full sample. All measures of aggregate trading activity—dollar volume, share volume, and number of transactions—increase sharply on days when the discount had a large change. The average dollar volume on days with large changes is $1,443,745, which is 98.5% higher than the weighted-average dollar volume of $727,445 for the full sample. Average share volume increased 136.3% when the absolute discount change exceeded 3%. Average trade size increased by 6.4% to $13,882 in the restricted sample. The increase in average trade size is inconsistent with small investors as noise traders.

Table 4 also provides trading activity for each size category. All categories show increases in share volume and number of trades, but the activity associated with institutional investors exhibits the greatest jump. Trades initiated by individuals and institutions increased 81.9% and 92.7%, respectively.

We next examine the role of buyer- and seller-initiated trades in discount fluctuations. Table 5 partitions the sample of large discount changes by sign and provides a breakdown by size of the buyer- and seller-initiated volume as a percentage of total volume. Panel A examines trading activity on days surrounding the 119 instances when the discount increased by more than 3%. The average seller-initiated volume associated with individual investors declines from 5.4% on day –1 to 4.9% on day 0, the day of the large increase in discount. Contrary to individual investors causing discount fluctuations, we find that the seller-initiated volume of individual investors on day 0 is not significantly different from days –1 or 1. In contrast, the average amount of selling by institutional investors escalates sharply when the discount widens. Seller-initiated institutional volume increases from 37.3% on day –1 to 45.7% on day 0 and then declines to 36.0% on day 1. In other words, almost half of the average volume on day 0 is selling by institutional investors. Additionally, the amount of buyer-initiated volume associated with institutional investors drops sharply from 31.2% on day –1 to 26.1% on day 0. Buying activity of individual investors does not change by a statistically significant amount on day 0.

Panel B of Table 5 provides a similar description of trading activity for the days surrounding the 124 days when the discount decreases by a large percentage. On average, 44.4% of the average share volume on day 0 is associated with purchases initiated by institutional investors; this represents an average increase of 11.3% of share volume from day −1. The average buyer-initiated volume associated with institutional investors is larger than the corresponding number from the four trading days before and after the large change; these differences are also statistically significant. Although the buyer-initiated volume from medium trades increased from 8.9% on day −1 to 10.1% on day 0, this change is not statistically significant. The average buyer-initiated volume from small trades actually drops

TABLE 5. Trading Characteristics Around Large Changes in the Discount.

	−4	−3	−2	−1	0	1	2	3	4
Panel A. Discount Increases									
Discount	4.12%	4.00%	3.47%	2.97%	7.27%	6.64%	6.35%	6.42%	6.34%
Discount change	−0.04%	−0.11%	−0.54%	−0.50%	4.30%	−0.63%	−0.29%	0.05%	−0.10%
Trades	61	62	69	74	93	81	71	62	63
Individual investors	36.1%	33.4%	34.8%	34.8%	35.5%	36.6%	37.8%	36.1%	36.8%
	(0.75)	(0.16)	(0.61)	(0.66)		(0.49)	(0.10)	(0.73)	(0.39)
Medium-size traders	23.7%	26.3%	25.1%	25.3%	23.4%	23.2%	24.6%	24.3%	25.6%
	(0.83)	(0.03)	(0.26)	(0.12)		(0.87)	(0.25)	(0.48)	(0.07)
Institutional investors	37.6%	37.5%	37.6%	37.9%	39.7%	38.1%	35.7%	36.9%	34.7%
	(0.19)	(0.23)	(0.19)	(0.26)		(0.27)	(0.00)	(0.12)	(0.00)
Buyer-initiated volume									
Individual investors	5.8%	4.8%	4.7%	4.6%	4.3%	5.7%	5.9%	5.3%	6.2%
	(0.07)	(0.40)	(0.39)	(0.55)		(0.01)	(0.00)	(0.07)	(0.00)
Medium-size traders	8.3%	9.0%	7.3%	8.1%	6.3%	8.3%	9.7%	7.9%	9.8%
	(0.02)	(0.00)	(0.19)	(0.04)		(0.02)	(0.00)	(0.05)	(0.00)
Institutional investors	32.8%	33.8%	31.5%	31.2%	26.1%	34.1%	31.0%	31.6%	34.1%
	(0.00)	(0.00)	(0.02)	(0.03)		(0.00)	(0.02)	(0.02)	(0.00)
Seller-initiated volume									
Individual investors	4.3%	4.1%	5.3%	5.4%	4.9%	4.2%	6.0%	5.0%	4.5%
	(0.34)	(0.10)	(0.48)	(0.41)		(0.22)	(0.21)	(0.85)	(0.50)
Medium-size traders	7.4%	8.2%	11.5%	10.2%	8.7%	7.5%	8.2%	9.1%	8.4%
	(0.16)	(0.64)	(0.03)	(0.09)		(0.10)	(0.53)	(0.65)	(0.77)
Institutional investors	36.7%	35.5%	34.4%	37.3%	45.7%	36.0%	36.6%	35.6%	32.6%
	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)
Panel B. Discount Decreases									
Discount	6.91%	7.05%	7.38%	7.96%	3.65%	4.31%	4.84%	5.03%	4.84%
Discount change	0.03%	0.14%	0.21%	0.56%	−4.31%	0.64%	0.52%	0.17%	−0.18%
Trades	70	65	70	78	96	77	69	65	68
Individual investors	38.0%	35.7%	38.8%	37.5%	34.5%	34.2%	36.0%	35.9%	35.8%
	(0.04)	(0.39)	(0.01)	(0.02)		(0.80)	(0.32)	(0.32)	(0.35)
Medium-size traders	23.7%	24.9%	24.3%	25.1%	23.7%	25.4%	23.8%	24.0%	24.8%
	(0.99)	(0.31)	(0.63)	(0.20)		(0.18)	(0.94)	(0.84)	(0.29)

(Continued)

TABLE 5. Continued.

	−4	−3	−2	−1	0	1	2	3	4
Institutional investors	35.8%	36.3%	34.2%	34.8%	40.6%	38.2%	38.0%	37.6%	36.9%
	(0.01)	(0.00)	(0.00)	(0.00)		(0.13)	(0.09)	(0.05)	(0.03)
Buyer-initiated volume									
Individual investors	6.2%	6.2%	6.7%	6.8%	5.5%	5.6%	4.6%	6.1%	5.7%
	(0.18)	(0.16)	(0.11)	(0.01)		(0.78)	(0.05)	(0.24)	(0.63)
Medium-size traders	8.7%	9.3%	9.7%	8.9%	10.1%	8.4%	8.7%	9.4%	9.6%
	(0.24)	(0.52)	(0.70)	(0.26)		(0.15)	(0.18)	(0.58)	(0.69)
Institutional investors	33.5%	32.4%	33.2%	33.1%	44.4%	36.2%	34.4%	36.6%	36.0%
	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)
Seller-initiated volume									
Individual investors	5.8%	4.5%	5.2%	4.6%	3.6%	4.1%	5.3%	4.4%	4.5%
	(0.00)	(0.03)	(0.00)	(0.02)		(0.24)	(0.00)	(0.09)	(0.07)
Medium-size traders	8.9%	8.3%	8.4%	9.2%	6.0%	9.4%	8.5%	7.8%	8.2%
	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.01)	(0.08)	(0.00)
Institutional investors	32.7%	34.1%	33.0%	33.5%	27.2%	32.8%	34.1%	31.9%	31.5%
	(0.02)	(0.00)	(0.01)	(0.00)		(0.01)	(0.00)	(0.05)	(0.05)

Note: This table describes the trading activity around the 243 occurrences when a closed-end fund discount changed by more than 3% in absolute value. Panel A presents the results for the 119 large increases in the discount. Panel B describes the 124 large decreases. The mean is provided for each trading characteristic. Below the mean, the *p*-value is shown for a two-sided test that the difference between the value for a particular day and day 0 is equal to zero. Buyer-initiated and seller-initiated volume is expressed as a percentage of daily share volume.

on day 0, suggesting that individual investors do not cause large changes in the discount.[4]

The most common expression of the noise trader model (Lee, Shleifer, and Thaler 1991) argues that small investors are uniquely sensitive to market sentiment, and their trading causes changes in closed-end fund discounts. As the average seller-initiated volume of individual investors does not increase on days with large discount increases and the buyer-initiated volume does not increase on days with large discount decreases, our analysis suggests that large closed-end fund discount changes are more complex than the noise trader model suggests. The trading of individual investors following large changes also supports this conclusion. The buyer-initiated volume of individual investors (as well as institutional investors) increases following discount increases, and the seller-initiated volume of individuals does not exhibit a statistically significant increase immediately following large discount decreases. The discount changes analyzed in this study coincide with changes in institutional trading. This may be a reflection of price inelasticity as these large investors put pressure on a market that does not regularly accommodate transactions involving significant share amounts.

Cross-Sectional Analysis

The empirical evidence shows that the average trading activity by institutional investors changes significantly when the discount changes. We next employ regression analysis to examine the relative importance of order-flow imbalance for each trader category while controlling for market conditions. Table 6 presents the estimated coefficients for the regression of the change in the discount as a function of the relative order-flow imbalance of small, medium, and large trades. The two-way fixed-effects model is used to estimate the error structure. The sample used to estimate the results in the first column consists of the 251 trading days when the absolute discount change exceeds 3%.[5]

Contrary to the prediction of the noise trader model, the relative order-flow imbalance of individual investors is not a statistically significant determinant of the change in the discount. The coefficient equals –0.0312, and the *p*-value for a one-sided test is .2985. The coefficient for the order flow associated with institutional investors is −0.0498. This is 60% larger in absolute value than the

[4]Large discount changes may occur on consecutive days. A smaller sample of isolated large discount changes is analyzed in the manner shown in Table 5. The results are essentially the same. In addition, the *p*-values from the parametric statistical tests shown in Table 5 are similar to those of the Wilcoxon signed-rank test.

[5]The sample used in the analysis presented in Table 6 is larger than the sample used to produce the results in Table 5. Our NAV data end on December 31, 1999. Some of the large changes near the end of this period did not have sufficient post-change data to be included in the analysis of trading characteristics around the large changes.

TABLE 6. Estimated Coefficients for the Regression of Large Discount Changes.

	Dependent Variable: Change in the Discount			
Independent Variables	Full Sample	Full Sample	Excluding Observations < 10th or > 90th Percentile for Total Relative Order Flow	Excluding Observations < 40th or > 60th Percentile for Total Relative Order Flow
Intercept	−0.0008	−0.0010	0.0004	−0.00433
	(−0.31)	(−0.39)	(0.14)	(−0.62)
Relative order-flow imbalance of	−0.0312	−0.0299	−0.0363	−0.1084
	(−0.53)	(−0.52)	(−0.51)	(−0.47)
individual investors	0.2985	0.3034	0.3070	0.3201
Relative order-flow imbalance of	−0.0610	−0.0608	−0.0994	0.0448
	(−2.31)	(−2.33)	(−2.59)	(0.28)
medium-size trades	0.0109	0.0103	0.0052	0.3908
Relative order-flow imbalance of	−0.0498	−0.0393	−0.0623	−0.0695
	(−6.38)	(−4.61)	(−5.29)	(−0.74)
institutional investors	0.0001	0.0001	0.0001	0.2307
Return on CRSP equally weighted index	−0.2490	−0.2043	−0.2261	−0.4886
	(−1.64)	(−1.36)	(−1.23)	(−1.05)
	0.0512	0.0893	0.1105	0.1486
Order-flow imbalance		−14.756		
		(−2.88)		
		0.0022		
Number of observations	251	251	201	50
R^2	0.2513	0.2758	0.2023	0.0489

Note: The relation between the change in the discount and order-flow imbalance is examined using times-series, cross-sectional regressions. The two-way fixed effects model is used to estimate the error structure. The Lee-Ready (1991) algorithm is employed to classify trades as being initiated by the buyer or seller, and trade size is used to identify individual investors (size < $5,000) and institutional investors (size ≥ $10,000). The order-flow imbalance is the difference between buyer-initiated volume and seller-initiated volume, and it is represented in millions of shares. Relative order-flow imbalance is the order-flow imbalance divided by the total number of shares traded during the day. The *t*-statistics are reported in parentheses. The *p*-values for a one-sided test are shown below the *t*-statistics. The regression results in the first two columns are estimated using all large discount changes. The third column contains regression estimates when the sample is limited to firm days with total relative order flow between the 10th and 90th percentiles of all firm days. The numbers in the final column are produced using observations with total relative order flow between the 40th and 60th percentiles.

individual investor coefficient and is statistically significant. The coefficient for medium trades is −0.061, which is statistically significant. Consistent with prior studies that find that closed-end fund discounts vary systematically with returns of small firm stocks, we find a negative relation between daily discount fluctuations and the daily return on the Center for Research in Security Prices (CRSP) equally weighted index. The estimated coefficient is −0.249 and is statistically significant with a *p*-value of .0512.

To determine the robustness of these results, a model is estimated with the total order-flow imbalance included as a control for price pressure. The results

in the second column show that the general conclusions remain the same. The coefficient for the imbalance of individual investors is still statistically insignificant (p-value = .3034) whereas the coefficient for the imbalance of institutional investors is significant. Furthermore, the R^2 of the model increases only slightly (27.58% vs. 25.13%) with the inclusion of the additional independent variable.

As an additional check on the effect of price pressure, the analysis is repeated excluding observations with extreme quantities of buying or selling. The third column in Table 6 contains regression results that are estimated without observations that have total relative order-flow imbalances less than the 10th percentile or greater than the 90th percentile. The coefficient for institutional investor imbalance remains statistically significant and the coefficient for individual investor imbalance remains statistically insignificant. If price pressure from larger institutional trades is generating the results in this table, eliminating the extreme observations would cause the coefficient estimate for the relative order-flow imbalance for institutional investors to be closer to zero. However, the absolute value of the coefficient becomes larger (−0.0623 vs. −0.0498).

The last column in Table 6 contains the regression coefficients estimated from an extremely reduced sample. Observations that contain total relative order-flow imbalances below the 40th percentile or above the 60th percentile are eliminated from the sample. As this sample only has 50 observations, none of the coefficients is statistically significant. Thus, as a further check for robustness, the regression analysis is repeated using the following cutoffs for dropping observations with extreme levels of total relative order-flow imbalance: 35th and 65th percentiles, 30th and 70th percentiles, 25th and 75th percentiles, and 20th and 80th percentiles. Although not reported to conserve space, the results from all four regressions show that the institutional investor coefficient is statistically significant and the individual investor coefficient is not significant.

In the next part of our study we determine which variables influence the probability of a large change in a fund's discount. Table 7 presents probit models of the probability of a large discount change. All of these models incorporate three independent variables: relative order-flow imbalance caused by individual investors, medium trades, and institutional investors. The first column shows the results estimated using the entire sample of 9,076 daily observations. The order flow associated with institutional investors has a coefficient of 0.2833 and a p-value of .0251. This variable has the largest effect on the probability of a large discount change and is the only statistically significant variable. The order-flow imbalance caused by individual investors has no statistically significant relation (p-value = .8319) with the probability of a large change in the discount.[6]

[6]This model is also estimated including an additional variable: the daily return on the CRSP equally weighted index (not reported). The coefficient for the market return is not statistically significant (p-value = .5646).

TABLE 7. Probit Model of Large Discount Changes.

	Binary Response Variable: Occurrence of a Large Discount Change			
Explanatory Variables (Absolute Values Used)	Full Sample	Full Sample	Excluding Observations < 10th or > 90th Percentile for Total Relative Order Flow	Excluding Observations < 40th or > 60th Percentile for Total Relative Order Flow
Intercept	−2.0055	−2.0046	−2.0318	−2.0882
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Relative order-flow imbalance of individual investors	−0.1416	0.2578	0.0641	−0.9591
	(0.8319)	(0.6846)	(0.9445)	(0.6487)
Relative order-flow imbalance of medium-size trades	0.2273	0.4142	−0.1647	−1.6656
	(0.5195)	(0.2319)	(0.7733)	(0.2972)
Relative order-flow imbalance of institutional investors	0.2833	0.0737	0.4594	2.6035
	(0.0251)	(0.5811)	(0.0414)	(0.0479)
Order-flow imbalance		4.4178		
		(0.0001)		
Number of observations	9,076	9,076	7,261	1,815
Pearson χ^2-statistic	0.5345	0.9553	0.5027	0.4745

Note: The relation between the probability of a large change in the discount (exceeding 3% in absolute value) and order-flow imbalance is examined by estimating probit models. The order-flow imbalance is the difference between buyer-initiated volume and seller-initiated volume, and it is represented in millions of shares. Relative order-flow imbalance is the order-flow imbalance divided by the total number of shares traded during the day. The *p*-values associated with the χ^2-statistic are shown in parentheses. The last row provides *p*-values for the Pearson χ^2-statistic; a large value indicates the model agrees with the data. The regression results in the first two columns are estimated using all observations during the sample period. The next two columns are estimated without the most extreme observations for total relative order flow.

To examine whether price pressure from large order-flow imbalances causes these results we estimate the probit model again. The second column in Table 7 shows a model that includes the total order-flow imbalance. When this additional variable is included, none of the other independent variables is statistically significant. The results from this model suggest that price inelasticity is important in explaining the impact of institutional investors in the market for closed-end fund shares. In the third column of Table 7, the analysis is completed using a sample without the observations that have total relative order-flow imbalances below the 10th percentile or above the 90th percentile. The coefficient for institutional imbalance remains statistically significant and the coefficients for the other two order-flow imbalance measures are insignificant. The final column shows the results from estimating the model on a sample that excludes all observations with total relative order-flow imbalances below the 40th percentile and above the 60th percentile. The regression shows that trading by institutional investors influences the probability of a large discount change but that the trading by individual investors does

not have a statistically significant influence on the occurrence of a large discount movement.[7]

As the final three models shown in Table 7 provide mixed results on the importance of price pressure from institutional investors, we do not dismiss the possibility that the price inelasticity is causing the order-flow imbalance of institutional investors to be significant explanatory variable for discount fluctuations. However, this does not affect our main conclusion that the trading of individual investors is not causing large discount changes.

V. Conclusions

The most direct test for the influence of noise traders in closed-end funds is an analysis of transaction characteristics around changes in discounts. Previous research fails to use daily NAVs and instead limits analysis of investor clienteles to weekly data. Hence, prior studies are unable to analyze transaction characteristics on days when changes in discounts occur.

In our study of daily discount fluctuations, we provide several unique insights regarding the pricing of closed-end funds. As the only research using daily NAVs, we document that substantial discount changes occur on a daily basis. Trading activity associated with institutional investors is strongly associated with daily discount changes. For days with large changes in the discount, average trade size increases 6.4%, share volume increases 136.3%, and the number of trades increases 85.4%. We identify transactions as seller and buyer initiated, and classify trades as those of institutions and individuals. On days when the discount increases (decreases), the percentage of sell (buy) orders increases for institutions. There is no similar change for small, individual trades. Regression analysis shows the probability of a large change in the discount is greatest on a day with a larger order-flow imbalance for institutional traders. Our study yields mixed results on whether this result is caused by price pressure associated with the large share amounts traded by institutions.

The transactions data used in this research do not support the hypothesis that small traders are noise traders that drive discount fluctuations. Instead, the order-flow imbalances of institutional investors are strongly associated with large discount fluctuations. If institutional investor trading—but not retail trading—influences

[7] We also used another approach for excluding observations with price pressure. Although the results are not shown to conserve space, the analysis is applied to a sample where the observations with large discount changes are excluded if the total relative order-flow imbalance is below the 10th percentile or above the 90th percentile within the sample of days with large discount changes. We also performed the analysis using the 40th and 60th percentiles as the cutoffs. In both models, the trading by institutional investors is the only statistically significant explanatory variable.

closed-end discounts, we must ask: Who are the noise traders? We find no evidence that they are the small investors who are supposedly sensitive to market sentiment.

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